

THE PSYCHOLOGICAL BULLETIN

INTEREST AND ATTENTION.

BY DR. FELIX ARNOLD,

New York City.

In the following paper I shall try to give a more or less sketchy account of the relation of interest to feeling and to attention, and then to take up a more or less positive account with possible logical and ethical implications.

The expression 'interest' is used very much in the manner in which young ladies apply the term 'perfectly lovely.' Interest is considered sometimes as a feeling, sometimes as attention, now as will and then again as sensationalist excitation. Interest as feeling, however, seems to be the prevailing dictum, especially since Stumpf brought out his much quoted sentence, '*Aufmerksamkeit ist identisch mit Interesse und Interesse ist ein Gefühl. Damit ist alles gesagt*' (*Tonpsychologie*, I., p. 68). It does not speak well for the thoroughness of the various psychologists who have taken this bodily from the text and appealed to it as an authoritative statement for the identification of interest and feeling. As far as I can remember, this sentence is quoted by Ladd, Sully, Stout and Miss Calkins, the last of whom by a most curious combination considers interest as a feeling of clearness (combining Stumpf and Titchener) and therefore as attention.

If one understands the general treatment among German psychologists of the term feeling, he would perhaps pause before taking Stumpf's statement and interpreting it in English sensationalist terms. As a matter of fact, Stumpf explains himself in his second volume. '*Gefühl*' here is seen to be not passive feeling, but a '*Lust*' in the German sense. Attention and interest are thus defined: '*Sie ist nichts anderes als die Lust am Bemerken selbst*' (II., p. 279). Further we find that '*Jedes Lustgefühl welches auf einen bloß vorgestellten Gegenstand gerichtet ist, kann in ein Wollen übergehen*,

sobald der Gegenstand wahrscheinlich oder sicher erreichbar scheint' (p. 283), and finally, '*Der Wille erzeugt hier also nicht sondern ist die Aufmerksamkeit*' (p. 69), i. e., where we have voluntary attention the will is the attention itself directed upon some cognitive content. Interest, then, according to Stumpf is not a feeling in the English sense of the term, but rather a desire, an appetite, a conative tendency.

Interest as pleasure hardly differentiates two distinct types of conscious moment, one in which there is only pleasure, and one in which interest exists. If interest is identical with pleasure, then every pleasurable state must be one of interest and *vice versa*, the same holding of course in the case of pain. But we do not find this in actual experience. Take for example the interest in the preparations for dinner, and the actual process of eating. In the former case the interest existing is due to the meaning which the preparations have for some future condition of the self concerned. In the preparations, for example, I see good things to eat, pleasant company perhaps, compliments and the like. But in the actual process of eating, there may be pleasure, but no interest. If the process has in it no reference to any future condition of the self, the interest is at an end and the pleasure begins; and it is confined to and ends in the present. As Professor Baldwin says: 'We could hardly say an oyster is interested when a sharp instrument is thrust painfully between his shells. The intrusion affects him and it is in his interest to avoid it; but it is truer to say that it hurts him than that it interests him' (*F. and W.*, p. 143). Interest seems rather to point to the future, while feeling as pleasure-pain is confined to the present.

Another aspect of the subject is sometimes unduly emphasized. This is the identification of interest with attention. James Mill, for example, treats interest as a feeling and also attention as a feeling and considers that 'having an interesting sensation and attending to it are but two names for the same thing' (*Analysis*, II., pp. 367, 368, 369). Stout considers interest as the hedonic tone concomitant with the activity of attention (*Anal. Psych.*, I., pp. 224, 225) while Titchener makes attention and interest as two sides of the same experience (*Outline*, p. 143).

While there is no doubt as to the concomitance of interest and attention when interest is actually present, some reservations might be made as to the closeness of their connection. If we restrict attention to cover that state of affairs in which there is the greatest clearness plus the motor adjustments, and interest to that meaning of the object

which refers to the future, we should, I think, be nearer the actual facts in the case. Perhaps this will be more clearly brought out if attention and interest are positively considered.

While it may be flattering to consider attention as some guiding activity, still this is a philosophical rather than a psychological conception. We do not feel any such selective principle buzzing around in our heads, and the most we can say is that there exists a felt tension in any moment of intense attention. Attention, rather, is that state of clearness and distinctness due to any difference, change or pleasure-pain elements in the incoming stimuli, or to the associative and supporting elements centrally excited; while on the motor side we have those end organ and muscle accommodations helping to produce such clearness.

The '*Blickpunkt*' aspect of attention has been made popular by Wundt, but it has been brought out before him by others. Thus Lotze compares attention with the '*Netzhaut des Auges*' (*Med. Psy.*, §37) and Fortlage considers it like '*der helle Blick des Beobachtens*' (*Sys. d. Psy.*, §12). The clearness and distinctness which are the determining features of attention likewise had been explicitly stated by Kant (*Anth.*, §6). This is the structural point of view. Attention is the state of greatest clearness and distinctness, the former referring to the relation between the parts of the content, the latter to the separation of the whole from a background (Wundt, *Grundzüge*, III., pp. 333-339; Jodl, *Lehrbuch*, II., p. 74; Titchener, *Exp. Psych.*, I., pt. II., p. 189). The motor processes considered as attention by Ribot, and emphasized by Bain, Lange, Münsterberg and others, may be considered as concomitant and reinforcing processes.

In any actual moment of attention considered in its concrete totality, this aspect of clearness and distinctness must be analyzed out of the whole complex present. Besides the series of tensions felt either as simple eye strain or total body attitude, we might add in the higher forms of attention the associated ideas which rise and aid in bolstering, as it were, in the focus, the idea concerned. Attention may be considered as a state of tensions; but this, it seems to me, is not a predominating characteristic under *all* conditions. The feeling of passivity, *as a feeling*, is much more evident in the less strenuous kinds of attention. And again, greatest attention is not characterized by greatest felt tensions; in fact such tensions are rather the sign of inharmonious accommodations and incomplete attention.

The difference in the elements producing such clearness and distinctness gives us the ground for differentiating the kinds of attention

possible. Where attention or the state of clearness and distinctness is due to difference, change or pleasure-pain, we have instinctive attention. Where the incoming impression excites associations without any special sense of strain we may call the attention assimilative. When the mental state has in it felt tensions due to lack of harmonious adjustment to a given situation, because of its lack of congruence with some end or aim, we have the so-called voluntary attention. The modifying terms do not change the essential meaning of attention here any more so than elsewhere, and simply refer to exciting causes or concomitant changes. Just as when we speak of a horse-car, of a motor-car or of a railway-car, we refer rather to a certain method of propulsion, or to accompanying circumstances; we do not consider a car as a horse in the first example, as a motor in the second and so on. Any definition of attention must be consistent throughout its various phases, and any theory which considers attention as volition, or as sensation, motor adjustment or what not, is simply emphasizing certain aspects of it.

While it may be necessary to posit an activity back of consciousness and thus consider attention as an increase in the intensity of such activity, such a treatment is rather metaphysical than psychological. I think that Stout, in his treatment of the subject, mixes these two standpoints in his discussion of attention. Passivity as a mental state, as a feeling, has existence from the purely psychological standpoint. Whether there is an activity constantly operative in such cases has, psychologically, nothing to do with the matter, unless it is felt as tension strain or what not. Attention as pure activity seems rather a subject for philosophical than psychological discussion.

As regards interest, we may treat it in its two aspects, conative and cognitive. When I am interested in any thing, I take a certain attitude towards it with reference to some possible future condition. I see in the object concerned the means of influencing some future condition of the self. If the object gives merely pleasure and carries with it no future reference, there is pleasure present, but no interest. I may, for example, take pleasure in gazing at some highly colored chromo, but I would take a real interest in looking at a visiting card of some friend. The picture as a pleasurable object merely, carries with it no future reference, is without interest. The bit of pasteboard calls up certain attitudes, certain future states which are to be realized, and in so doing has interest. I anticipate a certain future state in which I shall feel a thrill of pleasure or what not. But I can hardly consider it an object of pleasure *per se*. I cannot say that the interest

is future pleasure, for it is now, it exists in the present and is a fact; whereas the future pleasure is not; it is something which may take place, but it has no present existence. This idea of the future state to be realized forms an important constituent of the state of interest existing. An example might aid in showing this. A newly elected president of a rapid transit company is reported to have said, 'All the interest the people have in me is how much they are going to get for a nickel.' It is highly probable that this president was not, as such, a pleasure producing object. But in so far as the people saw in him the possibility of influencing them, in some way, just so far did he hold their interest.

Interest, therefore, may be considered as a body attitude determined by a guiding cognitive content. For purposes of convenience these are treated separately, but they always in greater or less degree exist together. The attitude is rather a body feeling than a pleasure-pain sensation. It is easier to explain wherein such attitude consists by treating it genetically. When, for example, I am confronted by some object unconnected with any of my former experiences, I go through a series of reactions. I take the object up, try to use it, look at it, test it, smell or taste it and so on. After a number of such experiences, I tend to consider such object as a thing to be treated a certain way. Upon meeting it again, instead of going through the whole series of reactions, I simply tend so to do, get ready as it were serially to develop them. Such attitude may be said to consist in the motor innervations aroused. Now, when an object has meaning with reference to some future condition of the self, this future reference is felt as an attitude, as a tendency towards certain adjustments which for various reasons, *e. g.*, time, lack of proper means, of possession, etc. may be impossible at once, or which may be on the point of being realized. In the latter case we would have a primary, in the former a secondary interest.

The meaning or worth which I attach to the object is simply consciousness of the attitude roused. An object has worth because it 'hits' me a certain way. I give it worth, I stamp it as a thing to be treated a special way, give it meaning because of such attitude. Only in this manner can I conceive of Professor Dewey's definition of interest as 'consciousness of value' to have any meaning.

Any attitude as a body feeling as such, is blind, is a striving to little purpose without more or less of the cognitive aspect present. The future condition to be realized, to be appreciated, must exist in some ideal form. If, cognitively, I see nothing in an object, if it is

not connected with some future condition of the self, it has for me no interest. But as soon as it concerns me in some manner, and in a way not restricted to the present, interest in such object exists for me. Interest on its cognitive side is the especial signification which an object or idea has with reference to some future condition of the self. Cut away all idea of futurity, and no interest is possible. Similarly, if all reference to the self is removed, interest likewise will disappear. So-called disinterestedness is merely a special form of interest, an interest which cannot be weighed by the pound or measured by the yard, as it were. But the self is concerned none the less.

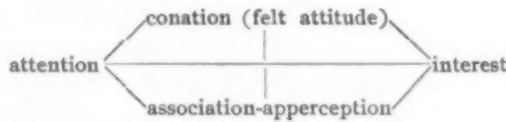
Examined as a form of consciousness, interest assumes two aspects. First we have the conative tendency towards a serial realization of motor innervations. Cognitively we have the revival of ideas or images giving direction to such tendency and explicating the meaning in the present with reference to some future state of the self. Any feeling of pleasure present is simply something added, something thrown in *gratis*, but something which does not constitute any essential part of the interest itself. Interest can exist equally with pleasure or displeasure considered as feeling. The general tendency towards adjustment to ideal conditions or in the direction of such conditions, and the struggle and alternation of attitudes arising, may give rise to a sense of effort, of tension or of strain. According as the attitude or the ideal factors in interest are emphasized, we have desire, expectation, curiosity and the like.

From this account of interest, it will be seen that interest is not concomitant with all forms of attention. When, for example, I start at a sudden flash of lightning, the state of attention instantaneous with the flash is not accompanied with interest. If, however, I then take an attitude, see in the present condition a menace, begin to seek shelter, and the like, interest is aroused. Only when associative processes due to previous experiences are possible, can interest arise. If we consider interest present in every state of attention, this would make the newly-born infant able to take an interest in everything, and would make teaching one long sweet dream. The child may be attracted or pleased by every new impression, but this is not interest. Interest, rather, may be considered as the residual effect of a series of acts of instinctive attention which make possible adjustments and striving, under future conditions of a similar nature.

I do not wish to be dogmatic on this point. But it seems to me that, at the beginning, there must be some short period in which the activity of a child is completely taken up with the present. To admit

the opposite would be to posit, as it seems to me, either innate ideas or ready-made adjustments. Striving as seen in the child seems to be more a feeling of unused activity, but this again seems to be confined at first to the present and has no future reference to the child. So, too, attention as primitive, *i. e.*, attention in some new field, or where the instinctive shock comes before adjustment towards it with reference to the future — such attention seems without interest at the beginning.

The relation between interest and attention in the highest stages may be shown as follows:



i. e., in the total attention-interest complex we have clearness and distinctness of the mental state, accompanied by felt tensions due to end-organ and other adjustments and associative processes aiding to hold the present moment in the focus; and on the side of interest, *in addition to the body tensions*, a body attitude due to the tendency serially to realize the meaning in the present with reference to the future, such tendency receiving guidance and support from the associated ideas referring to such future state.

The logical form in which the relation between interest and attention may be well shown, has been brought out by Professor Dewey in his Columbia lectures and discussions. Considering any proposition logically, as predicating certain things of any given, the subject would give us the '*Blickpunkt*,' the focus, the object in attentive consciousness, and the predicate would constitute the cognitive aspect of the interest present. Or if we consider that any meaning present is due to the attitude taken, the words themselves being a mere collection of marks, or auditory impressions, the conative attitude would also be included. But it has been said above that interest is concerned wholly with the future, and predicates may be past, present or future. This brings us closer to the full meaning implicit in any predicate.

Taking any predicate dealing with the past, *e. g.*, 'The fire has burned him,' the past experience is given as a warning for the future, as a sign pointing to future possible adjustments. 'The fire has burned him, and may burn you' is the complete meaning, or something of the kind. This is well shown in the cry, 'The king is dead! Long live the king!' Even where such implication is not so evident, it may be found. 'The house has fallen,' for example, may refer to

the future insofar as it means a certain state of quiescence, certain necessary adjustments, or what not. If one tells me in a casual way 'The house has fallen,' and it in no way concerns me, being simply an experience ending with the present, any interest signified by the predicate will not be interest for me, though it may be for the speaker. We are interested in the past chiefly as it points futureward, and those who simply dream of and enjoy past experiences in ideal form, are similar in kind to the individuals who practice the maxim, 'Let us eat and drink, for to-morrow we shall die.'

The ethical implications of the above view of interest need be only suggested. The development of a person's character is in reality nothing more than the development of a system of interests. It is the significance which a thing has with reference to some future state that determines one's attitude towards such thing. An interest is not a fleeting bit of sensationalism, but an enduring acquisition, a manner of interpreting and reacting. And judgment of a given situation will be determined by the interest of the person concerned. An individual in reality is as free as his interests are wide, and his power of judging is limited to the implications existing for him in the present moment, while the moral character of such judgments depends upon the nature of the interests formed.

PSYCHOLOGICAL LITERATURE.

PSYCHOLOGICAL STANDPOINT.

Der doppelte Standpunkt in der Psychologie. MARY WHITON CALKINS. Leipzig, Veit & Co., 1905; American agent, C. A. Kühler, Boston. Pp. 80.

The old associationist treatment of consciousness, more logical than psychological, considered consciousness as consisting of a series of ideas, such series, moreover, being considered *in abstracto*. In what lay the fault of such a view? Miss Calkins has given us a carefully prepared monograph to show wherein such a treatment is lacking, and has also supplied what in her opinion is necessary. According to Miss Calkins, we must supplement the structural standpoint by what she calls the point of view of the 'self-psychology' (*Ichpsychologie*), *i. e.*, a view of consciousness as the consciousness 'of a personal self in all its relations and phases' (p. 9), a psychology of selves, as it were.

At this point a question seems to me to remain unanswered. Granted a consciousness which is always in relation to another self or subject, a social consciousness as it were (pp. 35, 36), how does that help us any as regards the serial explanation? I do not here wish to uphold any special theory, but simply to seek light on the modification of the English view by the psychology which is treated as a science of selves. It seems to me that the latter method is trying to explain the problem by scattering it among a number of selves, by losing it in a multitude. Now, granted a series of ideas, how can we help explain consciousness by making such ideas social, or related to other selves? By relating them to other selves, we still leave them in all their barrenness, they still are discrete, they still remain atomistic and self-sufficient. If each is related to a number of other selves, we have the same old series with further complications which remain unexplained. Miss Calkins becomes somewhat more explicit in the treatment of perception and ideation, and perhaps it is here that the two standpoints are shown as mutually supporting each other.

In the former case, according to the one point of view, we have simply a succession of percepts which may undergo the usual analysis. According to the other standpoint, that of psychology treated as a sci-

ence of selves, every perception of an object has with it the added experience of a feeling due to the presence of concomitant observers who also perceive this object. 'In perception,' says Miss Calkins, 'I am always conscious that I am sharing the experience of others' (p. 42). This seems evident to Miss Calkins for the following reasons: (1) We verify a doubtful perception by appealing to the experience of others; and (2) we are able according to this theory to understand why we class some impressions as 'higher' than others. Visual impressions are considered the 'highest,' so Miss Calkins says, because they are such as can be shared by the greatest number of individuals (p. 43). And to the possible objection that we may perceive objects when no one is around, Miss Calkins even then by a continual appeal to introspection feels the object as one which *may* be experienced by others. 'Solitary and alone,' says she, 'when, in my study, I am aware of my desk for example, I have at the same time an indistinct consciousness that other persons, were they present, would see the same thing' (p. 43).

These seem to be very good reasons, but have they really anything to do with the case? Is it moreover a fact that this vague, dreamy, haunting feeling of another's possible presence is always involved in any perception? Is there not a most vicious example of the psychologist's fallacy here present? This objection can be safely left to the reader's judgment, without further remark by me. Concerning the verifying of perception by means of the experience of others, is this also a fact as stated? The point at issue in the latter case, it seems to me, is the *kind* of experience needed for verification, whether my own or that of others. Do we always need to verify our experience by such social appeal; or do we not rather of our own account attempt in verification to explicate our attitude by a series of reactions or motor adjustments? This point, too, I think can be safely left to the reader. Finally, as regards perception, supposing all the above mentioned statements of Miss Calkins to be correct, I do not see how such social awareness has anything to do with improving the structural view of consciousness as a series of abstract moments. We have simply the same old series, plus an awareness that others have or can have a similar series.

Further, as regards imagination and thought: "Psychologically, to distinguish imagination or fancy from perception, we must have recourse to 'self-psychology.' * * * The world of perception is in fact the world in common, which lies open to all. On the other hand, dreams and images belong only to individual beings" (p. 45). A

rather subtle fallacy is here involved, which is also present in the social theory of perception. It is, briefly stated, the following: Since there is a common world to perception, therefore, the common world of perception gives us a world of common or shared perception; and experience as self-experience must on that account necessarily be different from that of every other. As a matter of fact, every experience, whether of perception or of thought, is uniquely self-experience; and perception of the same object can be shared only insofar as the meaning of such object is the same for all concerned. Moreover, as regards ideal revival, there is nothing to prevent a number of individuals from having the same idea, *as idea*. As regards sameness, is there not just as much possible in the case of the image as in the case of perception? Sameness of object is not necessarily community of experience, nor is sameness of experience necessarily shut out in all ideation. Is it not just on this latter that most social appeal rests?

Underlying the whole treatment of '*der doppelte Standpunkt*' are the following misconceptions: (1) The isolation of the self as opposed to community of knowledge (one question, mainly epistemological) is confused with the twofold aspect, structural versus functional psychology (another problem). Miss Calkins takes the structural point of view, and opposes it to the problem of the community of knowledge, which, wrongly it seems to me, she calls functional (p. 33). (2) The consideration of psychology as a science of selves is simply one aspect of the treatment of psychology which views consciousness as always concerned with an object. From a psychological standpoint 'social' means nothing. I am just as sociable, psychologically, when I press closely a much prized object, as when I press softly the hand of a friend, or share my experience with him or with her. Psychologically I take an attitude towards each. Psychologically I can abstract from the present moment and by analysis seek certain elements. But as far as sociability is concerned, there is just as much in the one case as in the other. The fact that the self is connected with other selves is simply a form of the more general experience that consciousness always has an object, that every moment of consciousness is filled with a content, and a variation of the philosophical view so well expounded by Royce, that the universe forms one interrelated whole.

Now Miss Calkins is perfectly justified in presenting her discovery as '*EIN*' *doppelte Standpunkt*, but hardly as '*DER*' *doppelte Standpunkt in der Psychologie*. As a personal contribution it is

acceptable on its own merits. But it seems hardly fair to foist it upon psychology in general. What the twofold aspect of psychology is, and wherein modern psychology is an advance on the structural view, is overlooked by Miss Calkins. This twofold aspect, as it actually exists, is seen in various fields. In literature we are beginning to emphasize the content, and the meaning, at the expense of the purely verbal and grammatical analysis; in pedagogy we have passed out of the Lockian view of the 'empty cabinet,' are forcing out the Pestalozzian practice of object teaching as such, and are appealing rather to self motivation and self activity under guidance; in biology, the study of function holds equal rank with that of structure; in philosophy we are ploughing out of the static into the dynamic view of the universe; and over all is arising the great cry, *What does it all mean? WHAT IS IT GOOD FOR?* Where no meaning is evident we tend to cast it aside, or leave it for academic disputation. Use as here mentioned may refer to an attitude merely, as well as the more violent form of reaction, and the æsthetic or 'useless' *is* of use in this sense. It is here where Bradley makes his mistake in his various criticisms of the modern movement. So too in psychology this twofold aspect, structural versus functional, is becoming more evident.

The inadequacy of the structural point of view in psychology to explain the various facts of consciousness has given rise to the functional and motor theories so ably put forth by Baldwin, Dewey, James (more in his various articles), and Münsterberg, the last named being classed, in spite of his 'motor' theories, as a structural psychologist, which it seems to me he is not in the least. Perception is studied, not simply as an agglutination of sense elements nor as an association-complex, but as an essentially motor process, giving meaning to the object concerned, and determining serial reaction towards such object. Images are not simply fleeting bits of sensationalist revival, but also logical aids to action; and, as such, require further analysis to determine the motor tendencies and the attitudes bound with them. Even by reducing all states to sensationalistic elements, we do not necessarily restrict ourselves to the structural view, for such very structural elements, if conceived as having meaning, may be motor, may help in constituting the attitude taken.

As I have said above, if we take the contribution of Miss Calkins as one originating with herself, and limited to her own views, we must take it for what it is worth. But it is hardly a correct discussion of the twofold aspect of psychology as it exists to-day, nor is it a proper presentation of the attempt to harmonize such opposing views, in the sensori-motor theories now of so much account.

The psychological analysis of sensational elements, of volition and belief, and of will and faith given by Miss Calkins in this monograph is essentially the same as that set forth in her excellent *Introduction to Psychology* and need not be further mentioned. Much work requires to be done towards a complete sensori-motor psychology, and Miss Calkins' attempt is valuable for at least stirring the waters of this stream.

FELIX ARNOLD.

NEW YORK CITY.

METAPHYSICS.

A System of Metaphysics. GEORGE STUART FULLERTON, Professor of Philosophy in Columbia University, New York. New York, The Macmillan Company; London, Macmillan & Co., Ltd., 1904. Pp. x + 627.

This book is divided into four parts dealing with (1) 'The Content of Consciousness'; (2) 'The External World'; (3) 'Mind and Matter'; and (4) 'Other Minds and the Realm of Minds.' Each subject is treated at length, and any adequate review of the work would require a very long article, rather than the few pages that can be given to its consideration in the BULLETIN. All that will therefore be attempted here is to call attention to a few of the points that seem worthy of study.

Part I. exposes the inadequacy of the 'psychological standpoint' in metaphysical work. From this standpoint the mind is regarded as 'quite shut up, so far as its immediate knowledge goes, to its own ideas; and though it may *think of* an external world, it is wholly impossible that it should look out of the windows and into the world beyond, at any moment of its existence' (p. 21). "In contemplating its condition of complete insulation, we are struck by the oddity of the fact that this whole doctrine rests upon reasonings in which it is assumed that the mind is *not* shut up to its own experiences, but directly knows an external world of things. The contradiction is palpable and unmistakable; between premises and conclusion there is an abyss which may be concealed by obscurity and confusion of thought, but which cannot be bridged by any legitimate procedure" (p. 24). Hence the metaphysician, if he is wise, must recognize that there are 'two kinds of thinking,' a psychological and a metaphysical kind, which 'are by no means the same, and one who does very good work upon the plane of natural science,' that is, the plane occupied by the psychologist, 'may still be incapable of doing good work of the latter kind, unless he has some degree of aptitude and has enjoyed some special training—a fact not infrequently overlooked, and sometimes

with disastrous consequences' (p. 27). The main defect in the psychological kind of thinking consists in supposing that while we are aware only of the psychic contents of consciousness, we can also be aware of the fact that some of these contents are symbols of a reality lying beyond. "If we know immediately only elements in consciousness, it is inconceivable that we should, by means of these, represent to ourselves elements of a different kind in so far as they are different" (p. 53). The problem then is, how to conceive of the elements of consciousness as elements of consciousness and at the same time as giving us a knowledge of an external world.

This problem is attacked in Part II. The result obtained by the discussion gives "a view of the nature of the external world which, I am glad to think, is not fundamentally new, even though it differs in some details from other doctrines with which the reader is familiar. Possibly some will be tempted to call it, at first glance, idealistic; but this name, with the associations that cling to it, can only lead to a misapprehension of its true nature, and I must beg that the doctrine be allowed to remain nameless, at least until this volume has been read through to the end" (p. 98).

The present reviewer is compelled to admit that after having read the volume through to the end, he is still unable, not only to give a satisfactory name to the doctrine, but even to understand it at all. The fault, it is unnecessary perhaps to say, is not to be found in any failure of the author to express himself clearly, step by step. Professor Fullerton writes here, as always, with enviable lucidity on every single point, but somehow when one at the end takes an inventory of the stock that the author has helped one to acquire, one finds that one has a regular department store on one's hands, well supplied with a most heterogeneous line of goods.

Take for example the question of the meaning of the external world. Reality, we are told, is ultimately bound up with sensation. "My ultimate reference is always to sensation; to sensations which have been experienced, or to sensations which may be experienced" (p. 102). "But what, after all, is meant by reference to sensation? How can a sensation be recognized as such?" (p. 103). Peripheral as over against central stimulation of the nervous system does not furnish the criterion, neither can vividness serve as a test (p. 103). "There is, then, but one ultimate method of deciding whether a given experience is to be classed as a sensation or not. We must discover whether it takes its place among those elements of our experience which so connect themselves together as to form what we recognize

as the system of material things" (p. 105). But "can anything be more irregular than the actual sense-experience which we have of things? * * * The world appears before the windows of the senses only in fugitive glimpses, and we may piece these together as we will, but they still remain ridiculously inadequate to make such a world as we conceive the world to be. * * * It is clear that we cannot take quite literally the statement that our *sensations* fall into an ordered system and constitute what we mean by a world of things" (pp. 106-7). The world "is rather a something built up out of the materials furnished by sense, supplemented by elements which, while not themselves sensations, are made to represent such. Sensations, memories of sensations, and imaginary experiences which are not memories, though their elements have no independent source, all enter into its composition. Our sensations, actual and remembered, are separated by gaps which must be filled before there emerges the system of experience which we call the world of real things" (p. 107).

But the non-sensational filling that it is necessary to put into the gaps does not go in as *imaginary elements*, but as *representatives of sensational elements*. "It is their content, so to speak, which belongs to the construction, not the content with the added characteristic of belonging to the class called imaginary. There is, thus, a sense in which we may say that the external world is constituted by the sensational elements in our experience. These elements appear to belong to it in a way in which other elements do not. They constitute it, and elements remembered or imagined merely represent it" (p. 108).

This sounds very plausible, but when we try to put it all together, we find difficulty. The criterion of sensation, be it observed, is behavior in experience (p. 104). To be a sensation, an element must take and maintain a place among our other experiences (*ibid.*), which 'so connect themselves together as to form what we recognize as the system of material things' (p. 105). But some of our imaginations do this without thereby gaining the title to be classed as sensations: the best we can do for them is to regard them as *representatives* of sensations. How then are we going to distinguish between sensations and representatives of sensations? Applying the criterion of 'behavior,' we should be compelled to admit that some imaginations have pretty good right to be called sensations, as they fit excellently into their places among our elements of experience. Except for differences in the manner of their psychophysical genesis, which we are told has nothing to do with their differentiation, I cannot see how we are to call some of these elements sensations and some merely representa-

tives of sensations. Once give me a clear test of sensation beside its accommodating behavior, and I can perhaps recognize some of these conformist elements as sensations and some as not sensations. But Professor Fullerton refuses to give me any other test than 'behavior.' But he avowedly makes a distinction between sensations and representatives of sensations. In doing so does he not furtively introduce some other test than that which he declares to be the only ultimate test? There are passages, it is true, in which the author lays emphasis on the fact that sensations 'enter *directly*' into the structure of the external world, while imaginary elements enter only as representatives of sensations (p. 117). We are not told, however, what is meant by this *direct* entrance of sensations into the construct called the external world. At least the reviewer cannot find such an explanation as would help him understand the author at this crucial point in his argument. On the contrary it appears that the author has here two very diverse views, according to one of which reality has nothing to do with the psychical characters of sensations as such, while according to the other the psychical character of sensations as such are unconsciously used as a basis of the all-important distinction between sensations and representatives of sensations.

Again, when we come to the difficult question of the difference between 'sensations' and 'things,' I find that distinctions once made are facilely given up, with the result that I do not know where I am expected to stand.

We are assured that there is a very important 'distinction between *the world as it is* and *the world as it seems to us*' (p. 418). It is a puzzling distinction, so we are also told, but we are led to expect that the puzzle will be solved for us. But while this solution is taking place we meet sentences like these. "And I answer: second, it is a misapprehension to suppose that 'the external world as it is' can be anything else than 'the external world as it is perceived by me,' or the external world as it is perceived by some other creature" (p. 431). "It should be borne in mind that it is not one and the same thing to say 'the external world,' and to say 'the external world as revealed to me'" (p. 456). Is there a difference between 'the external world as it is perceived by me' and 'the external world as it is revealed to me'? Or is there a difference between 'the external world' and 'the external world as it is'? It is hard to conceive what either of these differences can be, but it is harder to conceive how, without some such differences, the two statements can be reconciled. In fact, a careful reading of what Professor Fullerton says about the rela-

tion of our perceptions to the external world has failed to give me anything like a clear idea of what that relation is according to his system.

One of the contentions that Professor Fullerton stands for most vigorously is that one cannot be an interactionist without being a materialist, unconsciously if not consciously. "It seems clear that what is known as the 'interaction' theory of the relation of mind and body gains what plausibility it possesses from the covert ascription of materiality to mind. When this is made apparent, and when a resolute attempt is made to remove every materialistic element from the notion of mind, then it also becomes clear that the attempt to build mind into the bodily mechanism, and to make it, at least for the time being, one of its constituent parts, is nothing less than absurd. The mind is not *present* to the body in any sense that would permit of its filling a gap in the bodily mechanism. Interaction becomes a mere word, the name of an empty nothing, and the impulse to insist upon it dies of inanition. No clear-minded man can take pleasure in maintaining that there is interaction between mind and body, if the word 'interaction' suggests to his mind nothing at all" (p. 284).

Now it must be admitted that many of the historical forms of interactionism have been tainted with materialism. But Professor Fullerton has not made it clear, unless repetition of an assertion can make anything clear, that materialism is necessarily involved in interactionism. It seems that Professor Fullerton cannot conceive of any kind of interactionism that does not assert a *mechanical* relation between mind and body. But does interactionism necessarily involve anything else than the contention that some physical events are — at least part — causes of psychical events, and *vice versa*? Now unless causation is limited to *physical* causation, with an equation of energy between cause and effect, there seems to be no reason for asserting that the doctrine that there is causal reciprocity between mental and physical events involves a materialistic conception of mind. In his account of the meaning of causation Professor Fullerton has not made causation a merely mechanical relation. "The relation of cause and effect is a temporal one, and marks the order of the successive states in the life-history of the system" (p. 234). It is also a necessary relation, but necessity is 'but another name for the orderliness to be discovered in the system of things' (p. 236). If this be the meaning of causation, then the interactionist who maintains that there is a causal relation between mind and body need only assert that there is an orderly sequence obtaining between psychical events and physical events.

Such an orderly sequence Professor Fullerton seems at times to be disposed to admit. Thus he says 'that the system of things as a whole, the universe which contains minds as well as material things, is a Cosmos throughout, and that its order seems to us now indefinite and more or less chaotic only because we are ignorant' (p. 392). Sometimes, in trying to escape the consequences of such an admission, he takes refuge in a distinction so subtle that one is tempted to wonder whether it is not merely verbal. He speaks of two distinct '*orders*,' the subjective and the objective, which however form one '*system*.' "That the two orders are not independent of each other, but form one system, must be admitted by every one, explicitly or implicitly" (p. 396). Now the question is, what is exactly the systematic connection between these two '*orders*'? Is it not one of orderly sequence? If so, is not interactionism true?

Rather than give an affirmative answer to this question, Professor Fullerton prefers to commit himself to the doctrine of the *timeless* character of the psychical, although he has been unsparing in his criticism of Green for maintaining the doctrine of the timeless character of thought. So far as I can see the only important difference between our author and the writer he grills over his critical gridiron is that Green asserted the timelessness only of *thought* while Fullerton asserts the timelessness of *all psychical facts*. Of course there are certain minor differences between the two thinkers. Green calls the timeless thought of his system '*eternal*.' Fullerton thinks that the word eternity is 'a mere sound when *all* reference to time has been stripped away' (p. 608). But the kind of reference to time that Fullerton allows to his *timeless* mind is as self-contradictory as that which Green allows when he calls thought an '*activity*.' To make this clear we must do some more quoting.

That the subjective order *changes*, Fullerton takes for granted, as indeed he must, if he is to keep in touch with experience. "Every subjective *change*, if it is to find an explanation at all, must find its explanation in the objective material system" (p. 372, italics mine). But how in the world can there be change in the subjective order unless that order is in time? And yet nothing seems clearer than that Professor Fullerton denies that the subjective order is really in time. "Of course, it is evident to the discriminating mind that mental phenomena cannot literally be assigned a place in real time, any more than they can be assigned a position in real space" (p. 391). Again, "The time which we seek is evidently *real* time. There is but one real time. The real time of an occurrence means the point, in the series of changes

which constitute the life-history of the real world, at which the occurrence takes place. The sensation, *as sensation*, cannot be assigned a place in this series of changes. When we speak of its time — its real time — we can only mean *the time of that material change* to which we relate the sensation as the plain man relates his sensations to his body" (p. 389, the last italics mine). Has this not a most familiar sound, and when one tries to recall where one has read the like of it before, do there not come to mind certain passages in the famous *Prolegomena to Ethics*? For instance this passage: "The consciousness which varies from moment to moment, which is in succession, and of which each successive state depends on a series of 'external and internal' events * * * consists in what may properly be called phenomena; in successive modifications of the animal organism"; while on the other hand there is a kind of consciousness "that constitutes our knowledge, with the relations, characteristic of knowledge, into which time does not enter, which are not in becoming, but are once for all what they are" (*Prol. to Eth.*, § 67).

Now, if mental phenomena cannot literally be assigned a place in real time, how in the name of common sense can they be 'protensive' (p. 468), and how can they 'change,' and how can there be a parallelism between their changes and those that take place in the body — in real time? A parallelism between changes in real time and 'changes' in — what shall I call it? — well, in something at any rate that is not real time, is surely something whose 'disappearance can only be brought about by substituting a habit for a habit — the habit of clear thinking, for the habit of thinking loosely and vaguely,' if Professor Fullerton will allow me to quote from his criticism of Green (p. 92).

Various other difficulties confront the reader of the book, but enough of them have been pointed out to show that a writer who finds 'logical monstrosities' (p. 608) galore in the works of other philosophers may keep at least a small dime-museum of them in his own.

And yet the existence of these 'monstrosities' does not negative the real value of this most interesting book. To my mind the most valuable feature of the volume is its destructive criticism of popular metaphysics. Such chapters as those on 'The Man and the Candlestick' (Clifford's metaphysics) and "The Metaphysics of the 'Telephone Exchange'" (Pearson's metaphysics) are as convincing as they are entertaining. They might have been shorter, as indeed the whole volume might have been considerably shorter, without serious loss, and yet after all one does not begrudge the time that is so delight-

fully whiled away in Professor Fullerton's company. Perhaps 'speaking inconsistently and growing incoherent,' and 'absurd and unmeaning,' and 'meaningless forms of words,' and 'hollow shells, without substance and without true reality,' and 'phantasms,' and 'chimeras,' and 'monstrosities,' and 'Egyptian darkness,' and scores of similar expressions met with in the author's criticisms of damnable heresies, are to be considered as among the amenities of philosophical controversy, when they are used, not in indignation, but in humorous vilification. Professor Fullerton's treatment of doctrines he abominates is often so exquisitely funny that even the victim of his abuse cannot refuse to join in the laugh raised at his own expense. When the opprobrious epithets are omitted, as sometimes they are, we have humor of the purest (American) sort. One example will suffice. "Descartes began with the resolve to repudiate all his previous opinions, and to take back only such as could really justify themselves before the impartial tribunal of his reason. But when he had cleared the room of all occupants, and opened the door for the admission of the elect, there entered unchallenged (*ex uno disce omnes*) a soul whose ticket primarily entitled it to a seat in the pineal gland, but which, not content with so definitely limited a location, insisted upon its right — one inherited from Scholasticism — to occupy simultaneously all the chairs in the room. This right poor Descartes admitted at once; he was so accustomed to having souls act in that way, and he expected of them nothing better" (p. 97).

The publishers' part in the production of the volume deserves unstinted praise. Typographical errors do not seem to exist, with the sole exception of 'sense-expressions' (p. 350) for 'sense-impressions.' The literary style of the book is matched by the beauty of the printed page.

EVANDER BRADLEY MCGILVARY.

UNIVERSITY OF WISCONSIN.

VISION.

Color Sensitivity of the Peripheral Retina. JOHN WALLACE BAIRD. Washington, D. C., Pub. by the Carnegie Institution, 1905. Pp. 80.

This monograph of Dr. Baird's sets forth the results of the careful working over of a problem in experimental psychology which has yielded varied and contradictory results at the hands of different investigators. The historical side of the paper presents, in as brief compass as possible, the results of nearly all the previous investiga-

tions on the color sensitivity of the peripheral retina. An examination of this literature shows a sad lack of harmony in the statements of the men engaged in this field. The author shows that many of the contradictions arise from the persistent failure on the part of the investigators to control the objective conditions of experimentation.

Summarizing the main facts of peripheral color sensitivity, about which there is an agreement by most of the men who have worked with care, we note the following in Dr. Baird's words: "It has been established that color sensitivity decreases gradually from the center to the periphery of the retina; that every color stimulus is correctly recognized within a certain retinal zone, whose extent varies directly with the color tone, the brightness (absolute and relative), the saturation, and the area of the stimulus, and with changing conditions of adaptation and of refraction; that under certain conditions the zone of a certain red is coextensive with that of a green, while that of yellow is also coextensive with that of blue; that the yellow-blue zone has a much wider extension than the red-green zone; that all colors, excepting the four mentioned above, pass through certain regular transitions of tone as they appear upon more and more peripheral regions of the retina; that these transitions tend in the direction of yellow (when red, orange, or green stimuli are employed) and in the direction of blue (when violet stimuli are employed); and that with moderate stimulation all colors appear gray at the periphery, while with a sufficiently intensive stimulation, they may there appear in their own tones."

Hellpach, as is well known, published an article in the *Phil. Studien* (Vol. XV., 1900, p. 524), the statements in which can not be harmonized in many particulars with those in the above summary. He devised a new form of perimeter which consisted essentially of an arrangement by means of which a movable stimulus lantern could be exposed at any part of the visual field. Hellpach built up his colors by inserting appropriate colored gelatines in the forward part of his lantern. He employed (with dark-adapted retina) red, orange, yellow, green, blue, violet and purple stimuli which he equated neither in white-value nor in color-value. His conclusions are curious. He found, firstly, that the 'yellow' stimulus (wave-length not given) did not arouse the sensation of yellow upon any part of the peripheral retina; secondly, that all his stimuli tended to appear in the *complementary* tones at the extreme periphery. Hellpach is convinced of the existence of four concentric zones upon the retina: (1) a central zone upon which all stimuli appear in their true colors; (2) a para-

central zone, where certain stimuli appear in adjacent or transitional tones, *e. g.*, violet appears blue upon this region; (3) a more peripheral zone where all stimuli are colorless, and (4) an outermost zone where they appear complementary to their true colors, *e. g.*, violet here appears yellowish. His stimuli gave non-coincident zones of red and green, and of yellow and blue.

Coming as it did from Wundt's laboratory, this paper has been a disturbing element in the minds of those who fondly hoped that at least the main facts of peripheral color sensitivity had been firmly established.

Stimulated, however, by these results of Hellpach, which are so out of relation with the findings of others, Baird endeavored to confirm the former's 'discoveries.'

The experimental portion of the paper under review is divided into two sections: Section I. deals with the chromatic character of the sensations aroused when a constant color stimulus is applied successively to different regions of the (dark-adapted) retina; section II., with the relative extension of the retinal areas within which the tones of the different color stimuli are correctly recognized (retina again dark-adapted). Section II. is of especial importance, since the zone of coincidence of yellow-blue and that of red and green has, in every case, been established only for the light-adapted retina — Hellpach, it will be remembered, denies the coincidence on the dark-adapted retina.

Under I. the apparatus used by Dr. Baird consisted of an exact duplicate of Hellpach's perimeter, of his light filter (for yellow) and an enormous supply of colored gelatines. The experiments were carried out in the dark room of the Cornell laboratory. The horizontal meridian, nasal and temporal, was used. Each sitting was preceded by fifteen minutes adaptation in absolute darkness. The method employed was a procedure without knowledge. The stimulus was exposed for three seconds. Periods of rest, from six to seven minutes, were allowed between stimulations. Five experienced subjects were tested.

SUMMARY OF RESULTS.

Red (706–631 $\mu\mu$) first appeared yellowish, then passed through yellow, orange-yellow, yellow-orange, orange and orange-red, before it finally appeared red.

Orange (640–592 $\mu\mu$) came in yellowish, gradually assumed a more and more orange-like tint and finally appeared orange or reddish orange.

Yellow (619–581 $\mu\mu$) first appeared yellowish, gradually increased

in saturation and became orange-like towards the center of the retina. This stimulus really contained a slightly orange tint.

Green (546-522 $\mu\mu$) appeared yellowish at first, gradually increased in saturation and toward the close of the series assumed a greenish and finally a green tint.

Blue (519-642 $\mu\mu$) underwent no appreciable change of tone, but became more and more saturated as the series progressed towards the fovea.

Violet (493-431 $\mu\mu$) appeared bluish, then blue, and took on a violet tint very much later. Indeed it sometimes happened that the violet tone of the stimulus was not recognized at ten degrees from the visual axis.

Purple (red end of spectrum 682 $\mu\mu$) gave the longest and richest series of transitions. Beginning with yellowish its tone gradually moved down the spectrum, passing through orange-yellow, yellow-orange, orange, orange-red, red, purplish-red and reddish-purple, before the pure tone of the stimulus finally appeared.

When different intensities of stimuli were used, the retinal zones of sensitivity expanded with an increase in the intensity of the stimulus. Dr. Baird, although he did not try it, thinks that if the stimulation were sufficiently intense, all colors might be recognized at the extreme periphery.

These stimuli were equated neither in color-value nor in white-value, consequently no effort was made under I. to determine the relative extension of the different retinal zones.

Besides the changes in quality of the stimulus noted above, two other phenomena were reported by all five observers: (*a*) progressive changes in the saturation and in the color tone of the sensation which result from continuous stimulation, and (*b*) variations of saturation and of color tone which result from changed conditions of the local chromatic adaptation of the retina.

Under (*a*) Dr. Baird reports that no matter how constantly and continuously the peripheral stimulus was applied, the sensation which it aroused was neither constant nor continuous. A marked decrease in saturation and sometimes in brightness occurred during the progress of stimulation. Frequently a pronounced change in color tone also appeared. However well saturated the color appeared at the first instant of exposure, it tended to fade out as the exposure continued, finally ending in gray. The persistence of color was found to be much greater upon the paracentral than upon peripheral regions. Yellow and blue faded out much less rapidly than did the other colors — while

purple and violet changed most rapidly. Variations in color tone were as pronounced as those of saturation. The tendency was toward changes in the direction of yellow and blue.

Under (*b*) an interesting phenomenon was noticed when the interval between stimulations was reduced to one minute or less. Instead of sensations which corresponded in tone with the objective stimulus or with such transitions as have been noted, the observer would report phenomena which seem at first sight to be of the most irregular and accidental character. This irregularity consisted often in the observer's seeing the color complementary to the objective stimulus. The writer tells us that the appearance of the complementary color is wholly due to a failure to maintain a constant condition of retinal adaptation, since all irregularity invariably disappears when the eye has rested for a time in complete darkness. The observers were wholly ignorant of the existence of these after-effects — they were attended by no after-images, nor in fact by any other conscious datum. Pauses were made and the subjects were asked to be on the lookout for after-images, but the report was invariably to the effect that no visual phenomenon of any sort was present to consciousness after the cessation of the stimulus. Dr. Baird concludes that the 'functioning of the peripheral retina is followed by an after-effect which is tenaciously persistent and is wholly latent in character; and that this subliminal capacity is called into active functioning by subsequent stimulation.' Hellpach's 'gegenfarbige zone' is then only a product of the latent effects of stimulation (retinal fatigue). His method of experimentation was most favorable for the operation of the residual after-effects of stimulation (see method in text).

Hellpach's 'discovery' that a yellow stimulus gives no sensation of yellow in indirect vision was not confirmed.

The experiments under II., designed to test the relative extension of the different retinal zones, were carried out upon the Hellpach perimeter (dark-adapted retina). The colors employed as stimuli were those which undergo no change in indirect vision. These stable colors were hard to establish. The following were finally decided upon:

Yellow.....	551-557 $\mu\mu$
Green	483-500 "
Blue.....	448-474 "

The stable red of these subjects transmitted no part of the visual spectrum. These four colors were carefully equated both in white-value and in color-value.

The results show that the zone of stable red is coextensive with that of stable green; that the zone of stable yellow is coextensive with that of stable blue; that the yellow-blue zone is much more widely extended in all directions than is the red-green zone; that the nasal side of the retina has the widest extension of color sensitivity, and that there is a wide individual variation in zonal extension. These conclusions are in harmony with those drawn from investigations upon the light-adapted retina.

A question may here be raised, the answer to which is not clear in the text: was the 'stable' yellow (for example), bounded in the spectrum by $551\text{ }\mu\mu$ on one side and $587\text{ }\mu\mu$ on the other, the stable yellow for all five observers? Or does the $551\text{ }\mu\mu$ - $587\text{ }\mu\mu$ represent the extreme limits of the spectral band between which the stable yellow for all five observers lie? Again, do the same equations for color-value and white-value among the four colors hold the same for all five observers? Or were the equations made separately for each individual? As a matter of fact, if Dr. Baird found a stable color of a given wavelength to be a stable color without change for two individuals; or if he found the same equations for color-values and white-values to hold for all five observers—he was, to say the least, extremely fortunate in his choice of subjects.

The paper closes with a discussion of the relation of the facts brought out above to the various color theories. The results are found to be explicable in terms of both the Hering and the Ladd-Franklin theories.

On the whole Dr. Baird seems to have done his work carefully and extremely well. His conclusions are a distinct contribution to the subject of peripheral color sensitivity.

JOHN B. WATSON.

UNIVERSITY OF CHICAGO.

Zur Kenntnis des zentralen Sehaktes. SIGM. EXNER. Zeitschrift f. Psych. u. Phys. d. Sinn., 1904, XXXVI., 194-212.

Exner offers a theoretical explanation of hemiambyopia in view of the more recent experiments of Hitzig and Imamura on dogs. The results accepted as valid by Exner may be grouped in four classes: (1) Hemiambyopia of the opposite side of the visual field will result from an injury to any part of the occipital lobe or the motor region controlling the eye (gyrus Sigmoides). The result is independent of the extent or position of the injury within these areas; (2) recovery of the defective vision will occur after some time; (3) immunity. After recovery from an occipital lesion, a motor injury will

produce no second disturbance, nor will an occipital injury after recovery from a motor lesion; (4) alternating amblyopia. After recovery from a right occipital lesion, injury to the left occipital lobe will cause a return of the first disturbance which is sometimes more pronounced than the right hemiamblyopia normally resulting from the second operation. Imamura made four successive operations with the following results: (a) A left motor operation produced right hemiamblyopia from which recovery was made; (b) a left occipital lesion produced no further effects according to the principle of immunity; (c) a right occipital injury gave first a left hemiamblyopia, followed by a reversal to the right hemiamblyopia, and then full recovery; (d) a right motor operation produced amblyopia, but more pronounced on the left side, which condition was shortly reversed. In other words, the effects may successively alternate between the two halves of the visual field.

Preparatory to an explanation of the facts the author analyzes perception from the physiological side, describing the diffusion of the initial stimulus over the brain, which diffusion forms the basis for the constitution of the stimulus as an object with meaning. He describes various defective perceptions, *e. g.*, optical aphasia, etc., due to lesions of some of these associative pathways. Further, he calls attention to the fact that many retinal stimulations never force their way into consciousness, as in retinal rivalry, distracted attention, pathological cases, etc.

1. Hemiamblyopia is allied to defective perception. Some of the diffusive associative pathways are disturbed in function and the object loses meaning and value to the organism.

2. Recovery is due to a gradual absorption of the perceptive function by the opposite hemisphere by means of the corpus callosum. As proof of this position he cites experiments by Imamura, who cut the corpus callosum after the recovery. The hemiamblyopia returned permanently. The section was also performed simultaneously with the causal lesion and no recovery was effected.

3. Immunity. Since the function is absorbed by the opposite hemisphere, a second lesion on the same side will produce no effect.

4. In alternating amblyopia the perceptive machinery of both hemispheres is defective; the animal can perceive, but poorly. If one half of the visual field be normal, no use would be made of the defective side, but when both sides are defective the animal is forced to rely as best he may upon this defective vision. In this condition, strain and fatigue easily occur and the alternation of the amblyopia is

due to an alternation of this fatigue from one hemisphere to the other.

Possibly some writers would object to Exner's selection and interpretation of the basal facts in the phenomenon, but granted the validity of his position in this respect, his theoretical explanation seems not only ingenious but possessed of positive worth.

HARVEY CARR.

UNIVERSITY OF CHICAGO.

Untersuchungen über den galvanischen Lichtreflex. DR. BUMKE.
Zeitschrift f. Psychol. und Physiol. d. Sinnesorgane, 1904,
XXXVI., 294-299.

It is known from the researches of others that a galvanic current between $\frac{1}{30}$ and $\frac{1}{6}$ m.amp. in strength will cause a sensation of light when passed through the eye. As the author has previously shown, a somewhat stronger current will also give a pupillomotor effect. Further investigations along this line were conducted with the aid of the Zehender-Westien binocular microscope. The large electrode was placed on the sternum or held in the hand of the subject. The small one was placed on the temple, close to the eye; or, if only the consensual reaction was to be tested, over the closed and protected eye.

When the current was passed from the temple through the eye, an average strength of 2.4 m.amp. was required to cause a contraction of the pupils 1-2 mm. at each closure at the anode. The movement and the following secondary expansion were analogous to the reflex from light. Next to the closing at the anode, the opening at the kathode was effective.

The subjective sensation of light seems to come before the motor result, at least so far as it is perceptible.

The attempt was made to use the galvanic reflex to decide what differences there are between the direct and the consensual reaction. The result was as ambiguous as that obtained by Fuchs; with some individuals the direct reflex comes first, with the greater number there is no such difference.

The behavior of the pupil in a condition of fatigue caused by staying awake all night was then investigated. The pupils of all subjects were larger in the morning after a night awake than at the same time on other days. The reaction to light was not changed, but the sensitivity of the iris to sensible stimuli was increased. The sensitivity to light from the galvanic current was increased somewhat, but the reflex sensitivity became less; if an individual perceived light with 0.1 m.amp. before, and a movement of the iris occurred with 0.2

m.amp., in a condition of fatigue, the values become respectively 0.08 m.amp. and 3.2 m.amp.

A satisfactory explanation of this difference cannot be given.

JOHN F. SHEPARD.

UNIVERSITY OF MICHIGAN.

DISCUSSION.

VISUAL SENSATION AND EYE MOVEMENT.

In a paper entitled 'The Illusion of Clear Vision during Eye Movement,' published in the *PSYCHOLOGICAL BULLETIN*, Vol. II., No. 6, appearing in June of this year, Prof. Raymond Dodge has adduced a variety of observations and arguments of which I am unable to catch the import further than that the author aims to invalidate some experimental results that I published in the *Harvard Psychological Studies*, Vol. I., appearing January, 1903. In my paper the conclusion was that some central anæsthesia prevents retinal stimulations given during voluntary eye movement from coming to consciousness until after the movement has ceased. Professor Dodge in his recent paper says that he 'should want to substitute the words inhibitory process for anæsthesia' in my statement. To this I have no sort of objection, inasmuch as in such a place the two words seem to me synonymous. Professor Dodge says furthermore, 'There is evidence, however, that the perception must occur largely if not wholly after the eye has come to rest, not on account of central anæsthesia during eye movement, but because of the latent time of retinal inertia and the transmission of nervous impulses.' He has, however, elsewhere said that 'eye movements of the first type * * * are primarily not periods of perception, but rather interruptions of vision';¹ and again, 'the most important characteristics of movements of the first type are * * * the fact that under ordinary circumstances of illumination and complexity of the field of view, they are never movements of new effective retinal stimulation.'²

The only conflict that I can so far discover between our two views, besides Dodge's rather captious choice of 'inhibitory process' in place of 'anæsthesia,' is that he ascribes the 'inhibitory process' to the latent time of retinal inertia and the transmission of nervous impulses. I cannot agree with this ascription, because the duration of the inhibition in my experiments was too great (being over 120 σ at the very least), and because, as I previously reported, there was good evi-

¹ *Amer. Jour. of Physiol.*, Vol. VIII., 1903, p. 316.

² *PSYCH. REV.*, Vol. XI., 1904, p. 3.

dence that the very optical stimulations that did not come to consciousness reached lower brain centers, and, before the voluntary movement was terminated, frequently changed it into a pursuit movement of Dodge's second type.¹ But neither does Dodge himself agree with his first ascription, for he says in the paper first cited (p. 197), "The lack of clear perception must rest largely, if not wholly, on other grounds [than anæsthesia]. Some of these at least are not far to seek. First, I believe we can demonstrate the influence of certain factors usually held to be retinal in their character; *and secondly, I believe we must admit, at least in the longer eye movements, evidence of important central factors.*"² The retardation of vision is then not due solely to the latent time of retinal inertia and the transmission of nervous impulses but to important central factors. These important central factors are what I thought it convenient to designate by anæsthesia.

Whatever opinion Dodge may have about the physiological facts, he is at least certain that my experiments are inconclusive, even in support of his own opinion. His objections commence on p. 194 of his first cited article, and I will take them up in turn.

A presumption, he says, is created against my 'anæsthesia' (his 'important central factors') by the fact that in the pursuit movements, Dodge's second type, vision is exceptionally clear. I quite agree with him as to the clearness of vision during pursuit movements, and I trust that his 'important central factors' evidenced in voluntary movements are not invalidated because of this fact. Dodge himself has shown beyond dispute that the two types of movement are quite distinct, and all my observations have confirmed his showings in this respect.

1. My 'pendulum tests * * * give results which can be interpreted as favoring central anæsthesia only occasionally.' Quite so: the adjustment of the eye movement to the pendulum swing was so delicate a matter that I made many trials that were not successful. Nor do I suppose that in experimenting Dodge stops after a few unsuccessful efforts. The evidence yielded by the many successful trials that were in the end obtained is absolutely unequivocal.

2. Dodge has been unable to realize voluntary eye movements of so slow a speed as were those that I chiefly used. This need not, however, have deterred him from repeating my experiments had he desired to do so. I have also made the pendulum test with more rapid eye movements, and found that with them also 'important central

¹ *Harvard Psychological Studies*, 1902, p. 42.

² *Italics mine.*

factors' prevent the retinal stimulations from coming to consciousness until after the movement is over.

3. "All the phenomena on which the hypothesis [of anæsthesia] rests may be explained without recourse to central anæsthesia [or 'important central factors'] on the assumption of discontinuous sweeps of the eyes, interrupted by these short movements. These are certainly not precluded by Holt's experimental conditions." They certainly are precluded (cf. my paper, pp. 24, 32, 36 and 42), and if they otherwise were not, a discontinuity of eye sweep could hardly explain the *absence* of sensation when, as Dodge must know better than almost anyone else, it is the one condition necessary in a voluntary eye movement for the *presence* of a sensation. These short and discontinuous movements are indeed apt to occur, and when they did occur the subject at first believed that he had had visual sensations *during* an eye movement.

Dodge asserts that 'the handleless dumb-bell would appear if the velocity of the eye happened to coincide with the angle velocity of the pendulum when the dumb-bell shaped opening was passing some other than the central part of the illuminated figure.' True, but the eye was also looking at the dumb-bell shaped opening as well when it was passing the central part: if the eye was at rest then it would have seen the handle; if not at rest it was moving, and still the handle was not seen. This was because of a central anæst—, or rather of 'important central factors.'

Again, the handle 'must appear if the illumination was near the threshold and the angle velocities nearly but not exactly coincided.' As I pointed out again and again in my paper, if the angle velocities nearly but not exactly coincided, as indeed frequently enough happened, the two ends of the dumb-bell must and did appear not circular but horizontally elongated. Such cases formed a part of the unsuccessful trials above mentioned.

'In view of the ambiguity of Holt's experiments' Dodge devised a combination of his own perforated disc and my pendulum exposure apparatus, in which a stimulus 5 σ longer than a threshold stimulus and present to the moving eye, was seen. 'There is evidence, however, that the perception must occur largely if not wholly after the eye has come to rest * * *. This seems to me,' he concludes, 'rather decisive evidence against the hypothesis of central anæsthesia.' But not, I trust, against that of 'important central factors.' I remain mildly curious to learn why my experiments are 'ambiguous,' and why Dodge's, which, though they were less careful, yet followed

mine as closely as Dodge found feasible and yielded identically the same result, should seem to him 'conclusive evidence' to the contrary. All who are interested in this topic, moreover, should master the nice distinction between 'important central factors' that inhibit sensation, and central anæsthesia.

EDWIN B. HOLT.

HARVARD UNIVERSITY.

EDITORS' ANNOUNCEMENT.

His colleagues regret that stress of other duties compels Professor Warren to relinquish the duties of the position of Business Manager of the REVIEW publications. In his place Dr. J. W. Baird, of the Johns Hopkins University, will assume the Business Management. We append a statement of the present location of the responsible bureaus of the REVIEW, with the appropriate addresses for the various sorts of communication.

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BOOKS RECEIVED FROM OCTOBER 5 TO NOVEMBER 5.

Ethik. M. WENTSCHER. II. Thiel. Leipzig, Barth, 1905. Pp. xii + 396. Mk. 9.

Twelfth Census of the United States (1900): Statistical Atlas. W. R. MERRIAM, Director; prepared under supervision of H. GANNETT. Washington, Census Office, 1903. Pp. 91, and 207 plates.

[A very important and beautiful series of maps and charts illustrating the statistical progress of the country up to 1900, in 'Population,' 'Vital Matters,' 'Agriculture,' and 'Manufactures.']

First Steps in Theosophy. E. M. MALLET. London, The Lotus Journal; New York, Lane, 1905. Pp. 93.

[A text-book dedicated to Annie Besant, and containing colored plates of the 'Astral Body' as influenced by different emotions.]

The Life of Reason. G. SANTAYANA. III. *Reason in Religion*; IV. *Reason in Art.* New York, Scribners, 1905. Pp. ix + 279, and ix + 230. \$1.25 net, each.

The Theory of Psychological Dispositions. C. A. DUBRAY. Psych. Studies from the Catholic Univ. of America. Mon. Sup. to the PSYCHOLOGICAL REVIEW, No. 30. New York, Macmillans, 1905. Pp. vii + 170. \$1.50.

Esquisse d'une Théorie biologique du Sommeil. Rep. from *Arch. de Psychologie*, IV. E. CLAPARÈDE. Geneva, Kündig, 1905. Pp. 245-349. 3 Fr. 50.

[Holds that sleep is an instinctive and defensive function whose biological utility is to forestall and prevent complete exhaustion.]

Vocabulaire philosophique. Fasc. 7, 8, E to Extrinsèque, contained in *Bulletin de la Soc. fran. de Philosophie*, June, July, 1905.

[Earlier parts of this *Vocabulaire* are reviewed in the BULLETIN, I., p. 123 (March 15, 1904).]

The Era Key to the U. S. P. A Complete List of the Drugs and Preparations of the United States Pharmacopœia. Eighth decennial revision (1905). Pharmaceutical Era, New York. Pp. 83.

